

ATTACK OF THE POCKET MONSTERS: NO LASTING EFFECTS

A Follow-up Survey on Seizures Induced by Animated Cartoon TV Program "Pocket Monster"

Ishiguro Y, Takada H, Watanabe K, Okumura A, Aso K, Ishikawa T

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PURPOSE: To identify the short-term outcome of patients who had seizures while watching an animated cartoon TV program, "Pocket Monster," on December 16, 1997.

METHODS: One and three years after the incident, questionnaires were sent to physicians of each patient about seizure recurrence, EEGs, and medication.

RESULTS: Among 103 patients in whom epileptic seizures occurred during the TV program and information on the outcomes was available, 25 (24%) patients had a history of unprovoked seizures before the incident (Epilepsy Group), and 78 (76%) did not (Non-Epilepsy Group). Twenty-three (22%) patients were reported to have seizures after the incident, and 15 of them had visually induced seizures. Patients of the Epilepsy Group had more seizure recurrence than did those of the Non-Epilepsy Group (56% vs. 9%; $P < 0.0001$), either for unprovoked (44% vs. 4%; $P < 0.0001$) or visually induced seizures (28% vs. 9%; $P < 0.05$). Of nine patients of the Non-Epilepsy Group who had seizures after the incident, recurrent unprovoked seizures developed in only 3. In the Non-Epilepsy Group, no difference was found in seizure recurrence between patients in whom valproate (VPA) was prescribed immediately after the incident and in those without medication [one of five (20%) vs. seven of 73 (10%); $P > 0.05$]. EEG was performed at least once in 98 patients after the incident. Photoparoxysmal response (PPR) was present in 45 (46%) patients, and spontaneous epileptiform discharges, in 49 (50%). PPR did not have any correlation with recurrence of seizures, either spontaneous or visually induced seizures, whereas spontaneous epileptiform discharges showed a good correlation with seizure recurrence (34% vs. 8%; $P < 0.01$), including visually induced seizures (24% vs. 2%; $P < 0.01$).

CONCLUSIONS: Short-term outcomes showed that 70 (68%) of 103 patients who had a seizure during the incident had no seizures before and during 3 years of follow-up.

COMMENTARY

The notorious "Pocket Monster" (Pokemon) television cartoon show aired in Japan in December, 1997, and precipitated seizures in several hundred Japanese children who watched the show (1). This event resulted in a deluge of young patients into emergency departments and raised fears among the public that television programs could cause epilepsy. Ishiguro et al. now report the 1- and 3-year outcomes of a group of 103 patients from a single Japanese prefecture who, according to physician reports, had had seizures in association with this incident.

The most important finding was that only 3 of the 78 children with no prior history of seizures had spontaneous recurrent seizures by follow-up, suggesting both that the event itself was not a precipitant of epilepsy and that it did not, in most cases, herald the clinical onset of a formerly preclinical epilepsy. Only 5 of the 78 children were treated after the incident, all with valproate (VPA), a remarkable display of sound judgment in taking a conservative approach among the large number of physicians involved. This wait-and-see attitude ultimately was justified by the low recurrence rate and by the finding that no difference in recurrence existed with or without treatment (i.e., 1 of 5 treated and 4 of 73 not treated).

As for the 25 patients who had a history of seizures before watching the cartoon, 23 had experienced at least some seizures by the follow-up, which is not a surprising finding. Premedication was not protective in this group—21 of the children were taking a variety of medications at the time of the incident. Data on the baseline degree of seizure control in this group are not given. It would be interesting to know if most of these patients had well-controlled seizures, which would emphasize the highly unusual and powerful nature of the cartoon stimulus.

A continuum of severity exists among patients with epileptic photosensitivity. At one extreme are patients with only electroencephalogram (EEG) evidence of photosensitivity: a photoparoxysmal response (PPR). Next, progressing in severity, are those with actual clinical seizures precipitated only by specific

visual stimuli. The more specific the stimulus required, the less severe the problem and the less likely that environmental stimuli will cause seizures. For the groups with only PPRs and those with seizures only with highly artificial stimuli, such as laboratory strobes or the Pokemon program, the term *photosensitive epilepsy* is a bit strong: in any case, they should not be treated with medication. In this regard, fully 40% of the children with a Pokemon seizure, but no history of seizures, had a PPR—significantly less than the 64% with a history, but, still, a high percentage. Next worst in seizure severity are patients who have visually induced seizures to common environmental stimuli, such as sunlight flickering through trees or routine television viewing. This is a small group. Most patients with epileptic photosensitivity have both visually induced and spontaneous seizures; clearly, this group requires medication.

The Pokemon incident also resulted in modification in television broadcast standards in Japan and the United Kingdom, based on a detailed analysis of the culpable features of the visual stimulus. The specific stimulus was a 4-second burst of red and blue light, alternating at 12 Hz. The red light was a pure red. The authors note that this color excites red cones alone and fails to evoke any inhibitory responses from blue and green cones. Presumably, the unopposed excitation, occurring at a frequency that created a resonant pattern in neural networks, was the problem. The frequency (10–25 Hz) is within the band most commonly associated with visually provoked seizures and PPRs (2). EEG laboratories should begin with flashes at 16 Hz, the most likely frequency to provoke seizure, because some habituation can occur such that the best chance of eliciting a PPR is with the first stimulus burst. The subject's eyes should be closed at the beginning of a burst, because the eyelids tend to pass more red light than open eyes, overriding the slightly reduced luminance in most patients. The Japanese experience is compatible with the idea that red light is more epileptogenic than white or other colors, and that color, not luminance, is often the more important factor in triggering seizures.

Pathophysiologically, this study provides evidence that the seizures were partial-onset with secondary generalization—not what we commonly assume about photosensitive epilepsies, which are typically a feature of generalized epilepsies, such as juvenile myoclonic epilepsy. Fifty-six of the 103 patients had partial seizures; partial seizures were more likely if patients were taking medications at the time of the incident. It seems likely that all reflex epilepsies are, in fact, partial-onset, that is, either partial anatomically (e.g., audiogenic seizures) or partial functionally (e.g., starting in a functionally related group of neurons, such as red cones). The generalized features represent rapid spread. Medication-inhibiting seizure propagation accounts for the higher incidence of partial seizures among pre-treated children in this study.

There are ways to reduce the chance of television-induced seizures (3). Broadcasting standards should be followed. Suggestions for safer screen viewing have included watching at a distance, backlighting, stopping TV viewing or videogame playing, and covering one eye with a hand if fatigue, nausea, or dizziness occurs. It is reassuring that most of these children attacked by the Pocket Monsters suffered no long-term effects and that a seizure caused by this highly provocative stimulus did not have ominous implications. Even those with EEG-detected PPRs should not be treated with medication unless spontaneous seizures follow. Longer follow-up is needed for the Pokemon victims, but it is likely that epilepsy will develop in only a few.

by Edward Faught, M.D.

References

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